Application No.: 10/524,551
Applicant: WISMÜLLER, Axel
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Title: Method, Data Processing Device and Computer Program Product for Processing Data
Art Unit: 2128
Examiner: Saif A. Alhija

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Clean Version of the Presented Claims as Requested by the Examiner

1. - 17. (canceled)

18. (currently amended) A system for generating codebook objects for an artificial neural network from input data comprising:

a processor;

a memory coupled to the processor;

computer code loaded into the memory for executing on the processor, for implementing the following functionality:

(a) providing data objects to be processed as input data and providing data objects of exploration space;

(b) generating a topology-preserving mapping, by:

(i) ordering neurons in ordering space, according to a given pattern;

(ii) assigning codebook objects in outcome space to the neurons;

(iii) processing codebook objects according to the calculation rule of a topology-preserving mapping, by use of data objects of the exploration space; and

(iv) outputting the processed codebook objects as output data;

(c) determining the order of neurons in the ordering space by using at least a part of the provided data objects, and

(d) providing data objects of the exploration space which are independent of the input data.

19. (previously presented) The method of claim 18, wherein the data objects to be processed are distance objects.

20. (previously presented) The method of claim 18,wherein data objects in the ordering space are ordered irregularly.

21. (previously presented) The method of claim 18, wherein data objects of at least one of the ordering space, exploration space, and outcome space are used which comply with at least one of the following conditions:

(A) they satisfy a non-Euclidian geometry;

(B) they are distance objects to data objects of a local neighborhood of data objects;

(C) they represent data distributions with a fractal dimension;

(D) they represent data distributions of non-orientable surfaces in the sense of differential geometry;

(E) they are added, omitted or modified during the training processes or a series of training processes of the topology-preserving mapping, in particular for distance objects in the ordering space;

(F) they are influenced by additional constraints;

(G) they are saved or processed in local units; and

(H) they are added, omitted or modified after completion of the training of the topology-preserving mapping.

22. (previously presented) The method of claim 18, wherein at least one of the calculation rule of the topology-preserving mapping and at least one parameter of this calculation rule:

is chosen depending on the respective processed data object of at least one of the ordering space, exploration space and outcome space;

is modified during the training process or over several training processes of the topology-preserving mapping, in particular depending on the respective processed data object of at least one of the ordering space, exploration space, and outcome space; and

is influenced by additional constraints.

23. - 27. (canceled)

28. (currently amended) A computer implemented system for determining the cluster validity of an artificial neural network comprising a computer processor coupled to a memory, the memory containing computer code for performing the following steps:

(a) storing data objects as input data;

(b) storing distance objects between these data objects;

(c) assigning the data objects to be processed to groups by:

(i) processing the data objects by using a topology-preserving mapping, by:

(1) ordering neurons in ordering space, according to a given pattern;

(2) assigning codebook objects in outcome space to the neurons;

(3) processing codebook objects according to the calculation rule of a topology-preserving mapping, by use of data objects of the exploration;

(4) outputting the processed codebook objects as output data;

(ii) both of the following substeps (1) and (2):

(1) determining the order of neurons in the ordering space by using at least a part of the provided data objects;

(2) providing said data objects that are independent of the input data to be processed and which are used as data objects of the exploration space;

(d) outputting a measure of the quality of this assignment as output data; and

(e) calculating the measure of the quality of the assignment by employing at least a part of the provided distance objects.

29. (currently amended) The system of claim 28 wherein step (e) comprises the steps of:

(f) providing data objects to be processed as input data;

(g) processing provided data objects by using a topology-preserving mapping; and

(h) applying a cost function of a method for the clustering of dissimilarity data, wherein the measure of the quality of the assignment is calculated by using at least one set of the set of substeps (h)(i) and h(ii) and the set of substeps (h)(iii)-(h)(vi) and a cost function of a method for the clustering of dissimilarity data:

(i) processing provided dissimilarity data objects by using a topology-preserving mapping, by:

(1) ordering neurons in ordering space, according to a given pattern;

(2) assigning codebook objects in outcome space to the neurons;

(3) processing codebook objects according to the calculation rule of a topology-preserving mapping, by use of data objects of the exploration;

(4) outputting the processed codebook objects as output data;

(ii) at least one of the following substeps (1) and (2):

(1) determining the order of neurons in the ordering space by using at least a part of the provided dissimilarity data objects; and

(2) providing said dissimilarity data objects that are independent of the input data to be processed and which are used as data objects of the exploration space; and

(iii) providing dissimilarity data objects to be processed;

(iv) calculating distances between the dissimilarity data objects to be processed as distance objects;

(v) outputting these distance objects as output data;

(vi) calculating the distances by use of at least one of statistical learning methods, local models, methods of inferential statistics, and one of the following specific computation methods:

(A) Levenstein Measure;

(B) Mutual Information;

(C) Kullback-Leibler Divergence;

(D) coherence measures employed in signal processing, in particular for biosignals;

(E) LPC cepstral distance;

(F) calculation methods that relate the power spectra of two signals, such as the Itakura-Saito Distance;

(G) the Mahalanobis-Distance; and

(H) calculation methods relating to the phase-synchronization of oscillators.

30. (currently amended) The system of claim 28, in which the computer code executes said steps repeatedly, wherein the output data of a previous run is stored as input data of a subsequent run.

31. (currently amended) The system of claim 28, comprising the step of:

(f) determining the quality of the output data and outputting this determined quality.

32. (currently amended) The system of claim 31 wherein the quality is determined by at least one of:

(A) calculating measures for topology-preservation or distribution-preservation;

(B) calculating distortion measures;

(C) relating the distances of data objects in the ordering space to the distances of corresponding data objects in at least one of the outcome space and the exploration space, in particular by plotting these data objects in a distance plot;

(D) graphically displaying data objects of at least one of the exploration space, the outcome space and the ordering space, in particular by applying these data objects to at least one of an exploration, outcome and ordering plot;

(E) graphically displaying data objects calculated from data objects of at least one of the exploration space, outcome space and ordering space, in particular by plotting these object data in at least one of an exploration plot, outcome plot and ordering plot;

(F) calculating and outputting the mapping error for at least one of an interpolation, extrapolation, approximation and supervised learning, in particular by forward and backward projection; and

(G) sequential processing of data objects.

33. - 38. (canceled)

39. (currently amended) The system of claim 18 wherein step (d) comprises the step of:

(e) generating the data objects of the exploration space according to a structural hypothesis.

40. (currently amended) The system of claim 28 wherein step (c)(ii)(2) comprises the step of:

(e) generating the data objects of the exploration space according to a structural hypothesis.